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ABSTRACT

This booklet offers energy savings concepts for Utah's public school districts. Topics cover energy efficient design for new buildings and additions, cost-effective energy upgrades during retrofits, maintenance and operating procedures for increasing energy efficiency, and funding options for school districts making energy upgrades. Appendices provide energy contacts for assistance and a sample energy management plan. (GR)

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SCHOOL ENERGY COSTS

A MATTER OF LEADERSHIP

ED 449 639

Utah State Office of Education

EF 005 152

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ACKNOWLEDGMENTS

Our acknowledgment and thanks to administrators in the 40 school districts in Utah who have taken the time to listen to suggestions on saving energy and who are committed to energy cost savings.

Larry Newton
Education Specialist for Property Tax & School Facilities
Utah State Office of Education

Darwin Woodbury, Ed.D.
Consultant
Box Elder County School District

Michael L. Glenn
Director
Utah State Office of Energy Services

Please visit the Utah Office of Energy Services WEB site for energy efficiency in public buildings at: *http://www.aste.usu.edu/docs/public.htm.* The Office of Energy Services also appreciates the efforts of Cara Thompson-Weir and Linda Nielson in the photography and editing of this booklet.

Educational institutions in the U.S. and Canada pay more than $7 billion a year in energy costs. In Utah, energy costs for schools exceed $33 million per year. This publication offers energy saving concepts for public school administrators, facility managers, teachers and maintenance staff. However, nothing will produce energy savings without the commitment of each district's superintendent and school board.

Ideas presented in this booklet are not without precedent; they have been used by a number of Utah school districts with great success.

WHY IS ENERGY SUCH A BIG DEAL?

INTRODUCTION

Our school buildings consume significant amounts of energy. Efficiency saves Utah school districts thousands of dollars annually. One example is Box Elder District, a relatively small district with 24 schools and more than 11,000 students. This district started a comprehensive energy efficiency program in 1993. *Total savings have exceeded one million dollars.* Sevier School District's 13 schools saved $ 32,000 in one year alone, and Davis District's 71 schools saved almost $2 million last year compared to normal baseline use.

Architects, engineers and school administrators owe state taxpayers the most efficient and cost-effective structures possible. Through your leadership, energy costs in our new and existing school buildings can be reduced while still enhancing the occupancy comfort, improving learning environment, and extending life expectancy of each building. As conscientious care takers of school facilities, we must reexamine the current energy conditions of our buildings, our operating budgets, and our maintenance procedures.

The following two-minute test assesses your district's energy condition:

1. Does the State Office of Education review your new construction and remodeling plans for energy efficiency?
2. Have you completed a comprehensive energy audit of your existing buildings?

3. Have all your building operators received energy management training?

4. Do maintenance staff perform regular preventative maintenance?

5. Have you installed state-of-the-art energy controls in all buildings?

6. Are each building's utility bills tracked through usage reports passed on to principals and/or facility administrators?

7. Does your district have an incentive plan for teachers, principals and custodians to share energy savings?

8. Have excessive peak load demand and power factor charges been mitigated?

9. Have you talked to staff about the people factor? (i.e. Are faculty, students, principals, and maintenance staff doing all they can do to avoid energy waste, such as turning off lights and not using space heaters?)

10. Have you used creative options such as state loans, equipment leases and the FinAnswer Program suggested by the *Utah Office of Energy Services* to finance energy efficiency equipment?

11. Have you increased rather than decreased your maintenance and operations budget this year?

12. Do district architects and engineers incorporate *super energy efficient design* features in your newest schools and additions?

13. If your district is larger than 15 to 20 buildings, have you hired a full-time energy manager?

14. Have you looked into the possibility of direct natural gas purchases from the well-head in order to reduce natural gas costs?

If you answered "yes" to ten or more of these questions, you are to be commended. If not, seriously consider the suggestions contained in this publication. Specific topics for energy efficiency are as follows:

1. Energy efficient design for new buildings and additions.
2. Retrofitting of existing buildings.
3. Increasing energy efficiency through proper maintenance and operating procedures. 4. Funding options available to your district for energy upgrades.

A list of other helpful resources is included in Appendix A. Implementing these suggestions can subsidize inadequate school budgets and save approximately $90,000 over the life span of each of your buildings.

USE ENERGY EFFICIENT DESIGN DURING NEW CONSTRUCTION FOR LONG TERM SAVINGS

Utah Energy Code and Super Energy Efficient Design

To reduce long-term energy costs, all public buildings in Utah must be constructed to meet the provisions of the Energy Code for Commercial and High-Rise Buildings based on ASHRAE 90.1 The Code gives owners of new buildings a minimum benchmark for energy efficiency. Upon request, many architects and engineers will design new *super energy efficient* buildings that exceed the minimum requirements of the energy code. The design for each new building or remodel must be reviewed by the Utah Office of Education, in partnership with the University of Utah Engineering Experiment Station, for Energy Code compliance.

Code Compliant Buildings Save Energy and Money

In 1995, the Oquirrh Hills Elementary School in Jordan School District was destroyed by fire. When a new school was built on the same site, the architect, engineers and district officials agreed to incorporate cost-effective, energy saving features to meet and in some cases exceed the Utah Energy Code.

With the same square footage and occupancy accommodations, this compact, rectangular, energy-efficient school includes Low-E glass; compact lights in recessed fixtures; T-8 fluorescent lamps with electronic ballasts; building controls connected to the district's

central energy management system for scheduling and set backs; vestibules; a light-colored roof to reduce cooling loads; high-pressure sodium exterior lamps; energy efficient skylights in the corridors, gym, and library; and a boiler system instead of rooftop units. Duane Devey, energy manager for that district says, "The list of energy efficiency measures installed in the Oquirrh Hills Elementary School should be on every district's checklist for new construction. Think of the long-term savings! Compared to the old school, after 11 months of occupancy, we have verified and attributed the $22,521 in electrical and natural gas savings to the new school's energy saving features."

Contact the University of Utah Engineering Experiment Station *(801-581-6348)* for more information about Utah's energy codes.

Going Beyond the Energy Code for School Design

Some Utah schools exceed the Utah Energy Code and are considered *super energy efficient*. Such buildings take advantage of several elements--the sunlight and it's heat, waste heat from equipment, natural human body heat, and natural cooling-- to the extent that little energy is needed to ensure a comfortable environment. *Super energy efficiency* also includes careful selection of building materials and landscaping in order to enhance environmental-benefits, thermal characteristics, reflectivity, and durability.

Super energy efficient buildings cost less to light, heat, and cool than other buildings. By using less energy, these buildings justify the initial extra cost of incorporating specially designed features. Over an average 30 year operations life-cycle for Utah's schools, energy

savings created by super energy efficient buildings become available for other educational programs. Year after year, this becomes a very compelling, long-term reason for using energy efficient concepts in new schools.

Super energy efficient schools in Utah include Oquirrh Hills Elementary, Jordan School District; Woodruff Elementary School, Logan School District; L.A.Young Intermediate, Box Elder School District; and Kane County High School in Kane County.

When commissioning an architect/engineer team for new construction, select one that will incorporate state-of-the-art energy technology in the design, *and* one that will apply sensitivity to long-term energy and maintenance costs. Although many Utah architects and engineers have developed expertise in *Super Energy Efficient Design*, each district must budget sufficient fees for designing new schools to the highest levels of energy efficiency. Michael Glenn, director of the Utah Office of Energy Services notes, "On average, fees for super energy efficient design are approximately one percent higher than fees for standard design. However, these additional fees are easily recovered through reduced long-term costs in the building operations."

Value Engineering is Important for New Construction

The planning and design process of every new school building must be critiqued through a *value engineering* process. Utah code 53A-20-102(2)(e) requires *value engineering reviews* of the plans and specifications for all building projects estimated to be more than $300,000. *Value*

engineering takes into account the cost of long-term building operations, and it ensures long-term building durability. The value engineering team consists of architects, civil and structural engineers, mechanical engineers, construction contractors, facility operations and maintenance staff, and other representatives from your district. Districts lacking time and in-house technical resources often hire independent energy engineers and architects to conduct the value engineering sessions. During these sessions, participants consider the optimum design features that will provide the most long-term benefits to the district. Districts that use a traditional *budget-design-bid-construct* process should incorporate desirable energy features as alternates in the bid. If the new building, remodel, or addition bid is under budget, the alternate features can be accepted into the final construction contract.

Decisions about energy efficiency features during the value engineering process should not be driven by the construction budget. Larry Newton of the State Office of Education cautions, "Budget-driven construction, where the budget is firmly set prior to design and construction bidding, typically results in inferior grade materials, inefficient equipment and long-term maintenance problems. To avoid budget driven decisions, we strongly recommend a non-traditional, two-step process that will enable district administrators and school boards to await completion of the design and value engineering process before setting construction budgets and prior to selling bonds for new facilities."

SET UP A PROGRAM FOR ENERGY ACCOUNTING/TRACKING

Although super energy efficient design in new school construction results in energy cost savings, most school district energy budgets are spent on heating, lighting and cooling existing buildings. To address problems in these older buildings, begin by compiling monthly and annual charts of *fuel and electricity use* using a dollar-per-square-foot scale. As a "rule of thumb", school buildings using more than $.75 per square foot need special attention.

Compiling, recording, and analyzing energy data is important for several reasons:

* Energy accounting identifies energy waste and equipment problems.
* Energy accounting provides year-to-year comparisons for concentrating limited energy retrofit funds to a district's largest energy users.
* Energy accounting prevents overcharges and errors on energy bills.
* Energy accounting quantifies the size of financial incentives due each school for the staff's energy-saving efforts.

Many Utah school districts have assigned staff members to *track energy consumption* and provide reports to maintenance officials, district administrators, custodians and principals. Through careful tracking, Alpine, Davis, Murray, Box Elder and Jordan school districts have uncovered thousands of dollars in utility overcharges-- more than enough to pay the salary of a district energy manager. In 1997 Jordan School District uncovered $93,000 in credits for one high school alone. Contact these districts for information on utility tracking software. (See sample tracking form, Appendix C.)

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Once school personnel know their building's energy consumption rate, district's can provide incentives to those who reduce it. Philadelphia's district-wide annual energy budget of $32 million cut utility costs by nearly $7 million per year over each of the past eleven years. Attributed to careful monitoring of each school's energy use, the savings is shared by each school for use in educational or recreational programs.

CAREFULLY EVALUATE THE MOST COST-EFFECTIVE ENERGY UPGRADES FOR YOUR BUILDING

After tracking energy consumption, districts should identify buildings with the highest consumption rate and prioritize them for *energy audits*. Ideally, energy audits are conducted by professional engineers or architects who are unbiased and not aligned with any particular vendor or supplier. However, energy audits can also be completed by district staff who have been certified through a course in energy auditing. The energy audit includes: an inventory of energy equipment, a calculation of a building's variance from optimum efficiency, observations for improved maintenance and operations, and general specifications for upgrading a building's equipment. The energy audit also includes examination of the structure (building envelope) and the HVAC and electrical lighting systems. Additionally, an auditor will estimate the cost of retrofitting and will assess the estimated payback period for each retrofit option. A copy of the walk-through energy audit form and a list of energy retrofits/measures worth considering for your buildings are available from the *Utah State Office of Energy Services*.

Larry Newton notes, "Whether completed by engineering professionals, utility company

representatives, vendors, energy service companies or in-house staff, energy audit information is a crucial management tool used for allocating scarce capital." Generally, the most cost-effective energy upgrades listed in the energy audits conducted for Utah schools include, but are not limited to the following: new electronic ballasts with T-8 lamps, centralized and upgraded building controls, steam trap replacement, pipe insulation, exterior high pressure sodium lamps with photo cell control, variable frequency drives on motors and pumps, summer hot water boilers, compact fluorescent light bulbs, fan/light timed switches, chiller upgrades, and motion sensors. Completing retrofit measures on older school buildings not only saves energy and money, it also reduces equipment downtime and improves building comfort.

How Do We Finance Energy Efficiency Retrofits?

Capital needed to fund energy efficiency measures in school buildings is becoming increasingly scarce, however Utah's school administrators can select from a wide variety of innovative financing mechanisms. Innovative funding options for retrofit projects include: internal revolving improvement funds, master leases with capital financing companies, general obligation bonding, guaranteed lease-purchase arrangements with energy service companies, and utility financing programs. Although internal funding and bonding[1] may cost less, some districts prefer using other financing mechanisms such as lease purchases or energy service companies in order to avoid increasing indebtedness.

Private-sector financial partnerships for finding energy improvements are not new to

[1] The Utah Guarantee Act of 1996 provides AAA ratings for all school district General Obligation Bonds. This has decreased the costs of bond interest statewide.

Utah school districts and public buildings. These partnerships have included utility companies such as Utah Power's Energy FinAnswer Program, Energy Service Companies (ESCOs) and capital financing companies. Private-sector partners successfully provide the expertise and financing that will ensure installation of energy efficient measures while guaranteeing that energy savings will exceed finance payments. Repayment terms commonly range between two and ten years. Often these partnerships can bring a project to completion much faster than a process of internal budgeting and bonding. This faster track allows a district to avoid lost opportunity or inflation costs.

Darwin Woodbury of Box Elder School District suggests, "When properly procured, there is little risk associated with using private-sector partners. Although some Utah school districts have had problems with such partnerships, successes have been achieved at Grand, Cache, Box Elder and Sevier school districts, the Utah State Hospital, and the Utah National Guard." Jordan, Alpine, and Granite School Districts report success with the FinAnswer program for several newer buildings. Utah administrators and facility managers who have successful *energy service company partnerships* advise fellow school districts to:

1. *Procure competitively* -- For districts interested in using of energy service companies, a list of prequalified ESCOs and a generic Request for Proposal (RFP) is available from the Utah Division of State Purchasing and the Utah Office of Energy Services. (See the OES WEB site at *http//www.aste.usu.edu/docs/improve.htm* for more information about procuring ESCOs).

2. *Retain independent technical expertise* -- Independent consulting engineers can assist private partnerships by inspecting the quality of workmanship and the equipment installed. They can negotiate contract changes to achieve highest energy savings, check compatibility of ESCO-proposed work against existing building systems, complete project commissioning, and verify the level of energy savings guaranteed by the ESCO. Funding assistance for consulting engineers is available through the Utah Office of Energy Services.

Some institutions have established *internal revolving energy improvement funds* -- a block of funds budgeted and allocated for building improvements. As energy cost reductions are achieved, the revolving fund is repaid with the savings. The funds are then reallocated for other projects from year-to-year until all buildings are completely upgraded.

REGULARLY SCHEDULED AND COMPLETED OPERATIONAL AND MAINTENANCE PROCEDURES REDUCE ENERGY CONSUMPTION

Regularly maintained buildings operating at optimum efficiency not only save energy but are more comfortable, and their systems are more durable. Progressive Utah school districts maximize the operating efficiency of each building's energy systems by adhering to monthly schedules used for checking and servicing building equipment. To properly maintain and operate energy equipment, head custodians may need special training in energy efficient operations. The

Utah Chapter of the Association of Professional Energy Managers offers local workshops and conferences. Call (1-801-538-8654 or 1-800-543-3563) for workshop schedules. On-line resources (training course inclusive) are found at the Utah Office of Energy Services WEB-site *http://www.aste. usu.edu/docs/OpsnMain.htm.*

Regular maintenance schedules of maintenance staff and facility managers are key to energy efficient operations. Just as important is the responsibility of district administrators to keep maintenance budgets at adequate funding levels. One Utah school district reports the equivalent loss of one school building per year due to deferred upkeep resulting from maintenance and budget cuts. Districts that cut operations and maintenance are using a *crisis management approach*, leaving crews in the position of "putting out fires". This approach consumes 10 to 15 percent more energy per building than does one having a well-funded, scheduled maintenance program coupled with well trained crews.

ESTABLISH DISTRICT ENERGY-SAVING GOALS & MANAGEMENT PLANS

Goals are the most important part of a district's *energy management plan*. This plan should contain specific objectives, timelines and targets for each building. Some districts have formed *ad-hoc* committees or teams that set district goals for energy efficiency, chart goal achievement, provide incentives and regularly evaluate problems and successes. This committee could include the district facility and energy managers, energy accounting staff members, maintenance department representatives, a principal, several teachers and a custodial

representative. See Appendix B for a sample Energy Management Plan.

SUMMARY

As energy costs continue to rise, school district and public building administrators find it necessary to reduce energy-use wherever possible in order to protect funds for educational programs. This booklet provides valuable guidance from the Utah Office of Energy Services and the Utah Office of Education.

Scott Bean, State Superintendent of Public Instruction, strongly urges Utah schools to ... *"develop an effective management system* that will include the following: careful consideration of *super energy efficient design* in new building design and construction, operational and maintenance practices for reducing energy use, and retrofitting of older buildings to eliminate major energy losses. **We need to take charge of energy use in our school buildings**," emphasizes Bean. **"Some districts are doing it, and others are not.** It is, however, ***a matter of leadership!***"

List of Appendixes

Attachment A - Great School Resources and Energy Contracts in Utah

Attachment B - Sample School District Energy Management Plan

Attachment C - Sample Utility Tracking Form

APPENDIX A

Great School Resources and Energy Contacts In Utah

Energy Auditing Forms, Workshops and Grants for Engineering Assistance

Michael Glenn or Denise Beaudoin

324 South State Street, Suite 500

Salt Lake City, Utah 84111

(801) 538-8654

1-800-662-3633

Districts with Computerized Energy Accounting

Duane Devey

Jordan School Dist.

9150 South 9360 West

Sandy, UT 84070

(801) 565-8770

Bernell Loveridge

Davis School Dist.

P.O. Box 1389

Freeport, UT 84016

(801) 774-7670

Ben Sorenson

Alpine School Dist

490 North State

Lindon, UT 84042

(801) 785-8733

Jim Batey

Box Elder School Dist.

230 West 200 South

Brigham City, UT

(801) 734-4800

Assistance with Energy Code Reviews and Energy Efficient School Design

Larry Newton
Utah State Office of Education
250 East 500 South
Salt Lake City, UT 84111
(801) 538-7668

Jerry Zenger
University of Utah Engineering Experiment Station
University of Utah, 138 KRC
Salt Lake City, UT 84112
(801) 581-6348

Jim Wingerden
Office of Energy &
Resource Planning
1594 W. North Temple, #3610
Salt Lake City, UT 84114
(801) 538-5428

Darwin Woodbury/Jim Batey
Box Elder School Dist.
230 West 200 South
Brigham City, UT 84302
(801) 734-4800

Associations You Can Join

Association of Professional
Energy Managers
Lori Bement
Utah Power and Light
P.O. Box 728
American Fork, UT 84003
(801) 361-3001

Utah Facility Operation and
Maintenance Association
Rick Conger
9361 South 300 East
Sandy, UT 84070-2998

Energy Saving Products/Equipment/Bulk Gas and Electric Purchasing

Reed Taylor/Rick Ashby

Division of State Purchasing

3150 State Office Building

Salt Lake City, UT 84114

(801) 538-3026

Districts with Success Working with Private-Sector Partners

Sam Ware/Ross Frank

Sevier School District

195 East 5th North

Richfield, UT 84701

(801) 896-4401

(Johnson Controls/ESCO)

Bill Bertollio

Bruce Parker

Cache School District

2063 North 1200 East

Logan, UT 84321

(801) 752-3925

(Johnson Controls/ESCO)

Duane Devey

Jordan School District

9150 South 500 West

Sandy, UT 84070

(801) 565-8770

(Johnson Controls and Honeywell Performance- Based Service Contract)

Bill McLeod

Granite School District

3409 East 3545 South

Salt Lake City, UT 84115

(801) 263-6215

(Wasatch Electric as ESCO)

Jim Batey

Box Elder School District

230 West 200 South

Brigham City, UT

(801) 734-4800

(Honeywell and Johnson Controls Performance-Based Service Contract)

Districts with Central Computer-based Energy Management Systems

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Bernell Loveridge

Davis School District

P.O. Box 1389

Freeport, UT 84016

(801) 774-7670

Ross Frank

Sevier School District

195 East 5th North

Richfield, UT 84701

(801) 896-4401

Duane Devey

Jordan School District

9150 South 500 West

Sandy, UT 84770

(801) 565-7275

Ben Sorenson

Alpine School District

490 North State

Lindon, UT 84042

(801) 785-8733

Rod Pace/Brian Peek/Jim Cooper

Murray School District

147 East 5065 South

Murray, UT 84107

(801) 264-7410

Districts with Successful Model Showcase Schools

Bill McLeod

(Roosevelt Elementary State-of-the-Art Lighting)

Granite School District

340 East 3545 South

Salt Lake City, UT 84115

(801) 263-6215

Tom Willardson

(Solar Heated School)

Kane County School District

746 South 175 East

Kanab, UT 84741

(801) 644-2555

Duane Devey

(South Jordan Elementary Passive Daylighting

and Oquirrh Hills Elementary for Energy Code)

Jordan School District

9150 South 500 West

Sandy, UT 84070

(801) 565-8770

Darwin Woodbury/Jim Batey

(Energy Code/New School Design)

Box Elder School District

230 W. 200 St.

Brigham City, UT 84302

(801) 734-4800)

Bernell Loveridge

(Thermal Storage for Cooling)

Davis School District

P.O. Box 1389

Freeport, UT 84016

(801) 774-7670

LuWayne Barber

(Passive Solar Design)

Washington School District

189 W. Tabernacle St.

St. George, UT 84770-3390

(801) 673-3553

APPENDIX B

Sample Energy Management Plan:

(1) Organize a district energy task force to oversee achievement of a district-wide ten percent reduction from base-year consumption in year one, and a 15 percent reduction in year two. (by July 1)

(2) Monitor overall consumption of energy units (therms, kWh, etc.)

(a) Purchase energy-tracking computer software or set up in-house spreadsheets. (by July 1)

(b) Assign a staff person to track and analyze all utility bills and provide comparative reports to district administrators, facility managers and principals on a monthly basis. (beginning July 1)

(3) Reduce peak demand and power factor costs in electrical energy use.

(a) Establish a policy for shop instructors, cafeteria personnel and art teachers to avoid use of electrical equipment (kilns, sawdust collectors) between 11:00 a.m and 2:00 p.m. where possible. (by September 1)

(b) Complete an assessment of each school's power factor charges and install correcting capacitors (by March 1 of next FY).

(c) Have staff person assigned to track energy use meet monthly with utility company representatives to rectify billing problems.

(4) Identify causes of excessive energy loss and prepare a list of cost estimates and pay-back periods for various corrective measures to include in the district's next budget. (by June 30 of next fiscal year)

(a) Have district facilities staff attend energy auditor training to become certified energy auditors.

(b) Complete energy audits of each building and prepare a list of priority funding measures for the school board's consideration.

(5) Make all users of the buildings aware of energy cost saving opportunites and motivate them to conserve energy. (by July 1)

(a) Institute a program of shared energy savings with staff at each school.

(b) Use the district energy task force to establish and award incentives and monitor district progress.

(c) Implement Energy Patrols in elementary schools.

(d) Include monthly energy saving tips in the district/school newsletter.

(6) Cut energy waste through a regularly scheduled and adequately funded maintenance program.

(a) Have maintenance officials establish a computer-based schedule for releasing work orders to check and maintain each school's energy using equipment. (by Jan. 1)

(b) Budget 10 percent more for maintenance for the next year. (beginning Nov. 1)

(c) Provide energy auditing and boiler maintenance training for all district maintenance staff. (beginning July 1)

7. Hire an engineer to oversee the procurement of an energy service company to upgrade energy using systems at all district buildings that were not funded as capital improvements by the school board (by September 1 of next FY).

(a) Prepare a Request For Qualifications to select the engineer (by July 1 of next FY).

(b) Secure matching funds from the Utah Office of Energy Services for engineering fees.

(c) Issue a Request for Proposal to Utah-based energy service companies. (by September 1 of next FY)

(d) Select an ESCO for partnering. (by November 30 of next FY)

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